

GOALI: Stability of Ni-base Superalloy Single Crystals - Training

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- 5 graduate, 5 undergraduate and 1 dual enrollment students working on developing database
 - As-cast microstructures
 - Heat treatment effects
 - Thermal stability
- Organizing UEF and TMS conferences on related subject
- Extensive time spent with industrial collaborator (P&W)
- Outreach program:
 - Engineering Fair for K-12 students (at right)
 - In-class visit for Elementary school enrichment class.



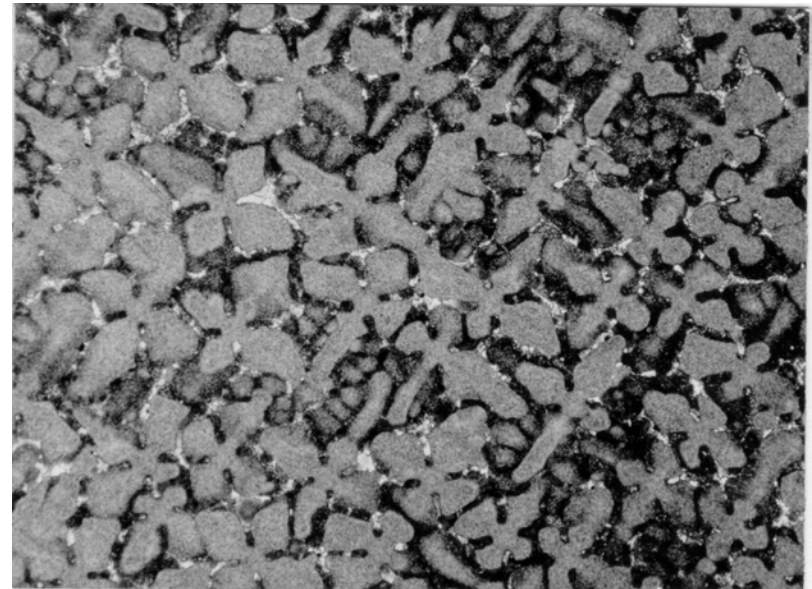


To date, 5 graduate student, 5 undergraduate students and 1 dual enrollment student have been involved in this program. All of the students have worked with each other and with the industrial collaborator (Pratt & Whitney). In fact, several of the graduate and undergraduate students are spending 3-6 months at Pratt & Whitney this year and are working in the lab on related projects. The students have characterized as-cast microstructures and developed unique heat treatments for some model alloys being evaluated. In addition, as part of the database being developed, the students have been involved with examining the long-term stability of these model alloys. Based on the research and the interactions with industry, two conferences are being organized. A UEF conference on “Advanced Materials for Gas Turbines” and a TMS symposium on “High Temperature Alloys: Processing for Properties” are being developed. Several of the students working on this program will be attending the conferences and making presentations. Some of the work on this project has been included in outreach efforts at the annual Engineering Fair on campus and were brought to the class room at a local elementary school enrichment class. The Engineering Fair exposed several hundred K-12 students from the local counties to materials science and engineering, with hands on experiments (as shown in the figure). In addition, some of the information and materials were also used in an in-class presentation by the PI and one of the students to a local elementary school enrichment class.

GOALI: Stability of Ni-base Superalloy Single Crystals - Results

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- As-cast microstructures fully characterized:
 - 18 models alloys
 - 4 commercial alloys
- Developed and characterized heat treatment effects
- Impact of results:
 - Recommendations for heat treatment for commercial applications
 - Provided direction for related research proposals to DOE, NASA, etc
 - Interaction with industry highlighted need for Center
 - » I/UCRC





Although this program is only approximately half way completed, the results of the study have proven to be quite useful for industry. To date, the as-cast microstructures of 18 model alloys and 4 commercial alloys have been fully characterized. In addition, the effect of heat treatments on the commercial alloys have been determined and unique heat treatments for the model alloys have also been developed. These results will be very useful for the development of the database for computational predictions. In addition, these results have already had a significant impact in several areas. Cannon Muskegon, donated test materials, and also has been able to apply some of the preliminary results to determine if a modified heat treatment would be acceptable for an elevated temperature application. Our results indicated that the modified heat treatment would have a detrimental impact on the properties. In addition, the preliminary results have also been used to prepare and submit proposals for additional related research in this field. More specifically, the results are being used to develop proposal for the development of an advanced single crystal superalloy for industrial gas turbine applications. If successful, this material would provide an enormous advantage to US industry in this field. Lastly, the industrial interactions that occur as part of this GOALI program have highlighted the need for a center for training of students. Therefore, we have prepared a submitted a planning proposal for a I/UCRC in this area.